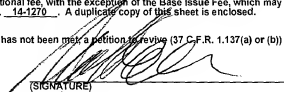| FORM PTO-1390 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NO. PHF 99,621
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U.S. Application No. (if known, see 37 CFR 1.5) **09/806091**

INTERNATIONAL APPLICATION NO. PCT/EP00/07425	INTERNATIONAL FILING DATE JULY 31, 2000	PRIORITY DATE CLAIMED AUGUST 3, 1999

TITLE OF INVENTION   METHOD AND DEVICE FOR ENCODING VIDEO SIGNALS

APPLICANT(S) FOR DO/EO/US: PIERRE GAUTIER ET AL

Applicant(s) herewith submit to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.

2. [ ] This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.

3. [X] This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).

4. [ ] A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. [X] A copy of the International Application as filed (35 U.S.C. 371 (c)(2))
    a. [X]   is transmitted herewith (required only if not transmitted by the International Bureau).
    b. [ ]   has been transmitted by the International Bureau.
    c. [ ]   is not required, as the application was filed in the United States Receiving Office (RO/US).

6. [ ] A translation of the International Application into English (35 U.S.C. 371(c)(2))

7. [ ] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
    a. [ ]   are transmitted herewith (required only if not transmitted by the International Bureau).
    b. [ ]   have been transmitted by the International Bureau.
    c. [ ]   have not been made; however, the time limit for making such amendments has NOT expired.
    d. [X]   have not been made and will not be made.

8. [ ] A translation of the amendment to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).

9. [X] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).

10. [ ] A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. [X] An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98.

12. [X] An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included.

13. [ ]   A FIRST preliminary amendment.
   [ ]   A SECOND OR SUBSEQUENT preliminary amendment.

14. [ ]   A substitute specification.

15. [X]   A change of power of attorney and/or address letter.

16. [X]   Other items or information:
    Application as published (WO97/3957)
    5 Sheets of Formal Drawings

U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/806091	PCT/EP00/07425	PHF 99,621

17 [ ] The following fees are submitted:

BASIC NATIONAL FEE (37 C.F.R. 1.492(A)(1)-(5)):

CALCULATIONS (PTO USE ONLY)

Search Report has been prepared by the EPO or JPO	$940.00	
International preliminary-examination fee paid to USPTO (37 C.F.R. 1.482)	$720.00	
No international preliminary examination fee paid to USPTO (37 C.F.R. 1.482) but international search fee paid to USPTO (37 C.F.R. 1.445(a)(2)	$760.00	
Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2)) paid to USPTO	$970.00	
International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)	$ 96.00	
ENTER APPROPRIATE BASIC FEE AMOUNT =		$970.00

Surcharge of $130.00 for furnishing the oath or declaration later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)).	$	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total Claims	4 - 20 =		X $ 18.00	$	
Independent claims	2 - 3 =		X $ 78.00	$	
MULTIPLE DEPENDENT CLAIMS (if applicable)			+ $260.00	$	
	TOTAL OF ABOVE CALCULATIONS		=	$970.00	
Reductions by 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 C.F.R. 1.9, 1.27, 1.28)				$	
		SUBTOTAL	=	$970.00	
Processing fee of $130.00 for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 C.F.R. 1.492(f)).			+	$	
		TOTAL NATIONAL FEE	=	$	
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28,3.31). $40.00 per property			+	$40.00	
		TOTAL FEES ENCLOSED	=	$1,010.00	
				Amount to be refunded	$
				charged	$

a. [ ]   A check in the amount $_____ to cover the above fees is enclosed.

b. [X]   Please charge my Deposit Account No. 14-1270   in the amount of $1,010.00   to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [X]   The Commissioner is hereby authorized to charge any additional fee, with the exception of the Base Issue Fee, which may be required, or credit any overpayment to Deposit Account No. 14-1270 . A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Corporate Patent Counsel
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(SIGNATURE)

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32,266
(REGISTRATION NUMBER)

DATE OF MAILING:

March 26, 2000

Method and device for encoding video signals   09/806091

FIELD OF THE INVENTION

      The present invention relates to a method for encoding video signals
corresponding to a sequence of frames each of which originally consists of two fields F1 and
F2, and to a corresponding encoding device.

BACKGROUND OF THE INVENTION

      In a video sequence, composed of successive interlaced pictures (or frames),
each frame is constituted by a pair of fields F1 and F2, as illustrated in Fig.1 showing
successive pairs of fields (each frame comprises a top field $F(2n-1)$ (with $n>0$), or odd field,
and a bottom field $F(2n)$, or even field, the odd frames being of type F1 and the even frames
of type F2) and the associated synchronization signal. When such video fields come out, for
instance at a rate of 50 fields/second (25 frames/second) or 60 fields/second (30
frames/second), either of a video camera or of any other type of video signal generator, the
video material has no field dominance (a frame is said to be "F1 dominant" if it is constituted
by a first field F1 followed by a second field F2, and to be "F2 dominant" if it is constituted
by a field F2 followed by a field F1).

      The field dominance becomes relevant when transferring data in such a way
that frame boundaries must be known and preserved. When the video material is edited at
frame boundaries, with a video recorder for example, a decision is provided for specifying if
the video material is F1 dominant or F2 dominant : Figs.3 and 4 respectively show, for a
preexisting video material as indicated in Fig.2, the structure of a F1 dominant video material
and of a F2 dominant video material. Once some material has acquired a particular
chrominance, it must be manipulated with that dominance. Otherwise, a shift can occur in the
representation of a frame, as shown in Fig.5 : the two first frames are F1 dominant, but the
third one is F2 dominant and composed of two fields which originally did not belong to the
same frame. In such a case, encoding is less efficient : a scene cut between the two fields of
an encoded frame costs a lot in terms of bitrate allocation efficiency. Moreover, F2
dominance may lead to annoying vertical moving of pictures when a DVD player outputs
frames in slow motion or still image mode.

SUMMARY OF THE INVENTION

It is therefore an object of the invention to propose an encoding method in which the above-indicated drawbacks are avoided and the picture quality of any encoded video programme is increased.

To this end, the invention relates to a method such as described in the introductory paragraph of the description and in which the encoding step is preceded by a preprocessing step which comprises the sub-steps of :

(A)   receiving the successive frames and delaying them with at least a "two fields" duration delay ;

(B)   adjusting said delay according to the following dominance change criterion :

(a)   when a change from an F1 dominance to an F2 dominance is detected, the first field of the first F2 dominant frame is suppressed, said delay being therefore decreased by a quantity equal to "one field" duration ;

(b)   when a change from an F2 dominance to an F1 dominance is detected, the last field of the last F2 dominant frame is repeated, the delay being therefore further increased by a quantity equal to "one" field "duration.

The method thus proposed allows to detect the changes in field dominance and to correct the input sequencing so that the frames can now be encoded correctly.

In an improved embodiment of the invention, in which the sequence of frames is constituted either by film-type images, to which the 3:2 pull-down technique has been applied, or by video-type images consisting of two fields, said method comprises the steps of:

(A)   detecting that the current sequence is constituted by film-type images ;

(B)   encoding said current sequence, either after said preprocessing step when it is not detected as being of film-type or after implementation, on said current sequence, of the inverse 3:2 pull-down technique if it is detected as being of film-type ;
and said detecting step comprises the sub-steps of :

(a)   defining for two successive fields $F(n)$ and $F(n+2)$ of the same parity a number of pixels N2 such as $N2 = NTOT - N'2$, where NTOT is the number of pixels in a field, N'2 is the number of pixels for which ABS (val $F(n)$ - val $F(n+2)$) < TH2, ABS designates the function "absolute value", val designates the luminance of a pixel, and TH2 is a first predefined threshold ;

(b)   comparing the result of the subtraction of two consecutive numbers N2, divided by NTOT, to a second predefined threshold THR ;

(c)   detecting that the current sequence is constituted by film-type images only when said result is lower than said second threshold, said fields being then considered as equal.

It is also an object of the invention to propose a corresponding encoding device.

To this end, the invention relates to a device for encoding video signals corresponding to a sequence of frames each of which originally consists of two fields F1 and F2, said sequence being constituted either by film-type images, to which the 3:2 pull-down technique has been applied, or by video-type images consisting of two fields, said device comprising :

(A)   means for detecting in the input sequence of frames a sequence of film-type images ;

(B)   means for receiving the successive frames of the input sequence, delaying each of them with a delay of at least two fields, and adjusting said delay according to the following dominance charge criterion :

(a)   when a change from an F1 dominance to an F2 dominance is detected, the first field of the first F2 dominant frame is suppressed, said delay being therefore decreased by a quantity equal to "one field" duration ;

(b)   when a change from an F2 dominance to an F1 dominance is detected, the last field of the last F2 dominant frame is repeated, the delay being therefore increased by a quantity equal to "one field" duration.

(C)   means for encoding the input sequence of frames, either connected in series with means (B) when said sequence is not detected as being of film-type or after implementation of the inverse 3:2 pull-down technique if it is detected as being of film-type.

BRIEF DESCRIPTION OF THE DRAWINGS

The particularities of the invention will now be explained in a more detailed manner, with reference to the accompanying drawings in which :

-Fig.1 shows, at a rate given by the associated synchronization signal on the time axis, a video sequence constituted by successive pairs of fields ;

-Fig.2 shows the successive frames F1, F2 of a preexisting video material, Figs.3 and 4 illustrate the structure of F1 dominant and F2 dominant video material,

and Fig.5 illustrates the case of a video sequence in which a shift in the representation of the frames has occurred ;

-Fig.6 shows an embodiment of a preprocessing device according to the invention ;

-Fig.7 illustrates the mechanism according to which the sequence is modified by suppression or repetition of a field, in relation with the type of dominance detection carried out in the preprocessing device ;

- Fig.8 illustrates the 3:2 pull-down technique which allows to construct a sequence of five interlaced frames, or pairs of fields $F(n)$ to $F(n+9)$, with $n=1$ in the present case, from four original sequential frames ;

- Fig.9 shows how fields are sequenced for the film mode format and illustrates the set of tests (identical ? or not ?) to be carried out for the detection of a 3:2 pull-down structure ;

- Fig.10 shows an encoding system in which the method according to the invention is implemented ;

- Fig.11 is an implementation of a preprocessing device comprised in the encoding device of Fig.10.

DETAILED DESCRIPTION OF THE INVENTION

An example of implementation of a preprocessing device according to the invention (before coding in a coding device 1003) is illustrated in Fig.6, in the case the input video stream is a sequence composed of information corresponding to images of the video type, i.e. composed (as already shown in Fig.1) of successive pairs of frames $F(1)$, $F(2)$,..., $F(i)$,... and so on.

Such a sequence is assumed to be F1 dominant, which corresponds in Fig.6 to the upper position of a switch 61 ; each successive input field IF is then delayed in a memory 63, with a delay of two fields, or at least two fields (this delay is illustrated in line (b) of Fig.7 for frames 1 to 3, by a comparison with the corresponding frames of the line (a)). When a change from "F1 dominant" to "F2 dominant" is detected by means of a circuit 64 for the detection of a field dominance change (instant t12 in line (a) of Fig.7), the switch 61, controlled by this circuit 64, comes back to its lower position (see Fig.6), for which each successive input field IF is now delayed in a memory 65, with a delay of only one field (or one field less, in the case of a greater delay for the memory 63). The first frame with F2 dominance is suppressed, and all the subsequent input fields are now delivered with only a

"one field" duration delay (see the frames 4 and 5 in line (b) of Fig.7), so that no gap occurs in the output sequence.

When a further change from "F2 dominant" to "F1 dominant" is detected by the circuit 64 (instant t21 in line (a) of fig.7), the last field F1 of the last F2 dominant frame is repeated in order to retrieve a correct sequencing : all the subsequent input fields are now, as initially, delivered again with a "two fields" duration delay (see the frames 6 and 7 in line (b) of Fig.7), or one field more in the case of a greater delay for the memory 63.

The detection of dominance in the field dominance change detection circuit 64 is for instance made through the use of a scene cut detection method, carried out between consecutive fields. Such a method is described for example in documents such as "Hierarchical scene change detection in an MPEG-2 compressed video sequence", by T.Shin and al., Proceedings of the 1998 IEEE ISCAS, May 31, 1998, Monterey, Ca., USA, pp.IV-253 to IV-256, or "A unified approach to shot change detection and camera motion characterization", by P. Bouthemy and al., IEEE Transactions on Circuits and Systems for Video Technology, vol.9, n°7, October 1999, pp.1030-1044.

An improved embodiment of the invention may also be proposed in the following case. In the NTSC standard, the picture frequency is 30 interlaced frames per second. However, for movies, the frames are produced at a frame rate of 24 Hz. When it is required to visualize a sequence of film-type images on television, it is therefore necessary to convert the movie's frame rate to the NTSC standard. The technique currently used, which is known as "3:2 pull-down" and is described for instance in the international patent application WO 97/39577, consists of creating five interlaced frames (which can be therefore visualized on television) based on four original sequential film frames. This is obtained by dividing each of these four sequential frames by two, so as to form four odd and four even fields and by duplicating two of these eight fields.

As illustrated in Fig.8, which shows a film sequence at 24 Hz on the first line and illustrates on the second line how to organize the field sequencing of a corresponding video sequence at 30 Hz, it means that an additional field is inserted for each pair of film frames, for instance by splitting one film frame out of two into three fields, the other one being split as usually into two fields. In the case of the frame split into three fields (for instance, G1G2 split into F1, F2, F3, or G5G6 split into F6, F7, F8), the third one is obtained by copying the odd (F1) or the even field (F6) alternately, in order to keep the sequencing "odd/even". The result is the following :

F1   = F3 = G1

F2   = G2

F4   = G4

F5   = G3

F6   = F8 = G6

F7   = G5

F9   = G7

F10 = G8, and so on.

These two additional fields obtained by duplication constitute a redundant information. When encoding such sequences according to the MPEG-2 standard, it is interesting to detect said information : the suppression of these repeated fields will then free some space to better encode the others, the concerned MPEG-2 encoder thus receiving video-type image sequences at 30 Hz and original film-type image sequences at 24 Hz.

An usual criterion to detect automatically sequences coming from movies (film-type image sequences) is therefore the following : a structure of five frames - i.e. of ten fields - is analyzed by means of a subtraction of consecutive fields of the same parity. The condition to detect the 3:2 pull-down structure is the following :

F1 = F3

F2 ≠ F4

F3 ≠ F5

F4 ≠ F6

F5 ≠ F7

F6 = F8

F7 ≠ F9

F8 ≠ F10,

which is illustrated in the sequence of Fig.9, where f1, f2,... designate the successive frames, 1o-1e, 1o-2e, 2o-3e,... the corresponding pairs of fields, y the reply "yes" to the test of comparison (i.e. fields equal), and n the reply "no" (i.e. fields different). If all these conditions are satisfied, then the inverse 3:2 pull-down conversion is performed on a group of five frames ; on the contrary, if one of these conditions is not valid, the encoder goes back to the video mode (no elimination of two fields).

However, due to the possible presence of noise on the original 3:2 pull-down sequence, the equality criterion between two fields (F1, F3 and F6, F8) may be not strictly verified. Two fields of the same parity F(N) and F(N+2) are considered. If NTOT designates

the total number of pixels in a field (172800 for a full resolution), val (F(N)) designates the luminance value for a given pixel, N1 is the number of picture elements (pixels) such as ABS[val(F(N)) - val (F(N+2))] > THRES1, Nm is the number of pixels such as ABS [val(F(N)) - val (F(N+2))] < THRES2, N2 is the number of pixels such as N2 = NTOT - Nm, and THRES1, THRES2 are predetermined thresholds, then the following test, Ratio 1 and Ratio 2 being values previously chosen, is carried out :

> IF ((N1 < Ratio 1) and (N2 < Ratio 2))   THEN : F(N) = F(N+2)
> ELSE   : F(N) ≠ F(N+2)

The first criterion (N1 < Ratio 1) may be called "the dissimilarity criterion" and involves the number of pixels where the field-to-field pixel difference is large, while the second one (N2 < Ratio2) may be called "the likeness criterion" and involves the number of pixels where the field-to-field pixel difference is small.

Troubles within the film mode detection step may consequently occur mostly in the case of the two following contrasted situations. For static or quasi-static sequences, the dissimilarity criterion is no more verified, since the fields are nearly all equal, and may be therefore suppressed, the residual conditions needed to be fulfilled being then only F1 = F3 and F6 = F8. But, for a very noisy sequence, with which two identical fields may however seem unlike, the threshold setting the likeness criterion cannot be too increased, otherwise fields that are different could be considered as identical. The criterion for detecting automatically sequences coming from movies may then be modified on the basis of the following remark. By looking at the N2 statistics (N2 has been defined hereinabove), the applicant has noticed that N2 for fields F1 and F3 (referenced N2[1,3]) and N2 for fields F6 and F8 (referenced N2[6,8]) are small compared to the others (more generally, N2[i,j] stands for statistics of N2 calculated for Fj-Fi). Then, by computing the difference between two consecutive N2 statistics, for instance : N2[6,8] - N2[5,7], and comparing - in the form of a percentage - such a difference to a predetermined threshold (according to an expression of the following form : N2[5,7]-N2[6,8] x 100/NTOT for example), a large value of percentage is obtained every five computations. Therefore, if the computed percentage is less than X %, with for instance X = 30 %, then both fields (of the last considered pair of fields) are considered as equal, and the inverse 3:2 pull-down processing is carried out for the next five frames.

An encoding system in which this preprocessing operation is included is described with reference to Fig.10. This encoding system comprises means 101 for encoding input signals corresponding to a sequence either coming from movies or of video type, means

102 for detecting in said input signals a sequence of film type (said detecting means being a detecting stage activated as explained later), and means 103 for switching, only when such a detection has occurred, from a first to a second mode of operation of the encoding means 101. The encoding means 101 comprise a first preprocessing device 1011, a second

5   preprocessing device 1012, and a coding device 1013, for instance an MPEG-2 coder.

The detecting stage, illustrated in Fig.11, itself comprise a set of subtractors 141.1, 141.2, 141.3,..., provided for receiving each one two successive fields of the same parity and determining per pixel the difference between these fields, followed by a set of circuits 142.1, 142.2, 142.3,... provided for taking the absolute value of said difference ; this

10   value is stored in a memory, 143.1, 143.2, 143.3,..., respectively. The successive differences between the successives values of these stored absolute values are then computed in subtractors 144.1, 144.2, 144.3,..., and these differences, for instance multiplied by 100/NTOT as indicated above, are compared to the predefined threshold (tests C1). If the fields are equal, i.e. they correspond to film-type images (in the present case, for F1 = F3 and

15   for F6 = F8), an inverse 3:2 pull-down processing can be carried out for the next five frames, in the first preprocessing device 1011 ; this situation corresponds to the lower position of the switching means 103. When it is not the case (video-type images), the switching means 103 are in the opposite position (upper position). The device 1011 is then de-activated, and in the same time the second preprocessing device 1012 becomes active (this device 1012 has

20   exactly the same structure as the preprocessing device of Fig.6).

An encoding system corresponding to this last description may be used for transmitting animated images with television systems operating at a frequency of 60 hertz (for instance with the NTSC standard used in countries such as Japan or the United States of America).

CLAIMS :

1.   A method for encoding video signals corresponding to a sequence of frames each of which originally consists of two fields F1 and F2, in which the encoding step is preceded by a preprocessing step which itself comprises the sub-steps of :

(A)   receiving the successive frames and delaying each of them with a delay of at least two fields ;

(B)   adjusting said delay according to the following dominance change criterion :

(a)   when a change from an F1 dominance to an F2 dominance is detected, the first field of the first F2 dominant frame is suppressed, said delay being therefore decreased by a quantity equal to "one field" duration ;

(b)   when a change from an F2 dominance to an F1 dominance is detected, the last field of the last F2 dominant frame is repeated, the delay being therefore increased by a quantity equal to "one field" duration.

2.   An encoding method according to claim 1, said sequence of frames being constituted either by film-type images, to which the 3:2 pull-down technique has been applied, or by video-type images consisting of two fields, said method comprising the steps of :

(A)   detecting that the current sequence is constituted by film-type images ;

(B)   encoding said current sequence, either after said preprocessing step when it is not detected as being of film-type or after implementation, on said current sequence, of the inverse 3:2 pull-down technique if it is detected as being of film-type ;

and said detecting step comprising the sub-steps of :

(a)   defining for two successive fields F(n) and F(n+2) of the same parity a number of pixels N2 such as N2 = NTOT - N'2, where NTOT is the number of pixels in a field, N'2 is the number of pixels for which ABS (val F(n) - val F(n+2)) < TH2, ABS designates the function "absolute value", val designates the luminance of a pixel, and TH2 is a first predefined threshold ;

(b)   comparing the result of the subtraction of two consecutive numbers N2, divided by NTOT, to a second predefined threshold THR ;

(c)   detecting that the current sequence is constituted by film-type images only when said result is lower than said second threshold, said fields being then considered as equal.

5   3.   A device for encoding video signals corresponding to a sequence of frames each of which originally consists of two fields F1 and F2, said sequence being constituted either by film-type images, to which the 3:2 pull-down technique has been applied, or by video-type images consisting of two fields, said device comprising :

(A)   means for detecting in the input sequence of frames a sequence of film-type
10   images ;

(B)   means for receiving the successive frames of the input sequence, delaying each of them with a delay of at least two fields, and adjusting said delay according to the following dominance charge criterion :

(a)   when a change from an F1 dominance to an F2 dominance is
15   detected, the first field of the first F2 dominant frame is suppressed, said delay being therefore decreased by a quantity equal to "one field" duration ;

(b)   when a change from an F2 dominance to an F1 dominance is detected, the last field of the last F2 dominant frame is repeated, the delay being therefore increased by a quantity equal to "one field" duration.

20   (C)   means for encoding the input sequence of frames, either connected in series with means (B) when said sequence is not detected as being of film-type or after implementation of the inverse 3:2 pull-down technique if it is detected as being of film-type.

4.   An encoding device according to claim 3, in which said detecting means
25   comprise a set of subtractors, provided for receiving each one two successive fields of the same parity and determining per pixel the difference between these fields and followed by a set of circuits provided for taking the absolute value of said difference and storing it, computing in subtractors the successive differences between the successives values of these stored absolute values, comparing these differences to a predefined threshold, and detecting a
30   sequence of film-type only when said difference is lower than a predefined threshold, said fields being then considered as equal.
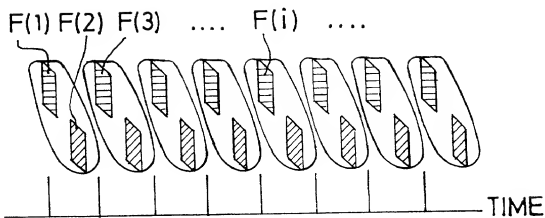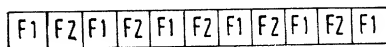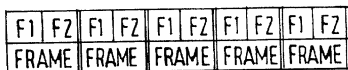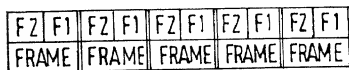
ABSTRACT:

     The invention relates to the processing of video signals prior to encoding or other compression operations, and, more particularly, to a method for encoding video signals corresponding to a sequence of frames each of which consists of two fields F1 and F2. The proposed method comprises the steps of receiving successive frames of an input video signal

5   and delaying them with at least a "two fields" duration delay, and detecting any dominance change and adjusting said delay. When a change from an F1 dominance to an F2 dominance is detected, the first field of the first F2 dominant frame is suppressed, and said delay is decreased by a quantity equal to "one field" duration ; when a change from an F2 dominance to an F1 dominance is detected, the last field of the last F2 dominant frame is repeated, and

10 the delay is further increased by a quantity equal to "one field" duration.

     The invention also relates to a method for encoding a sequence of frames including either video-type images or film-type images, and to an encoding system that carries out said method by incorporating the first solution hereinabove presented. If a sequence of film-type is detected, the inverse 3:2 pull-down technique is applied on the input

15 frames, while in the opposite case, said technique is de-activated and replaced by said first solution : preprocessing according to the type of dominance change.

Fig. 6

FIG.1

FIG.2

FIG.3

FIG.4

F1	F2	F1	F2	F2	F1	F2	F1	F2	F1
FRAME		FRAME		FRAME		FRAME		FRAME	

F1 DOMINANCE | F2 DOMINANCE

FIG.5

FIELD SEQUENCING   ORIGINAL 24 Hz

G1	G2	G3	G4	G5	G6	G7	G8

VIDEO 30 Hz

F1	F2	F3	F4	F5	F6	F7	F8	F9	F10

FIG.8

f_1 f_2 f_3 f_4 f_5

1_0 1_e 1_0 2_e 2_0 3_e 3_0 3_e 4_0 4_e

y
    n
        n
            n
                n
                    y
                        n
                            n
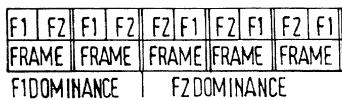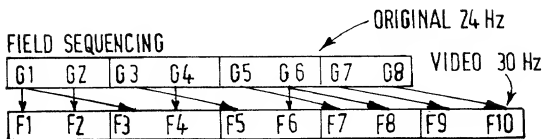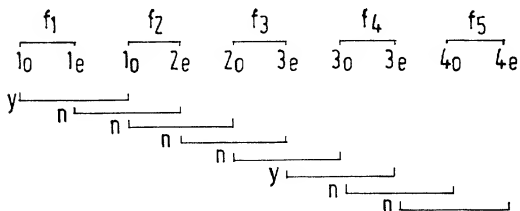
FIG.9
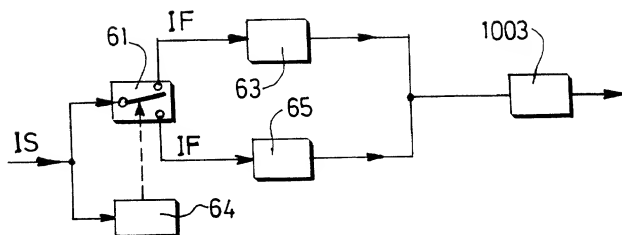
FIG.6
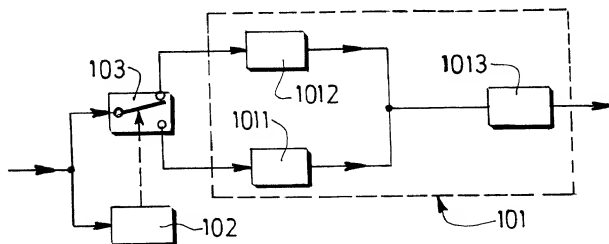
FIG.10
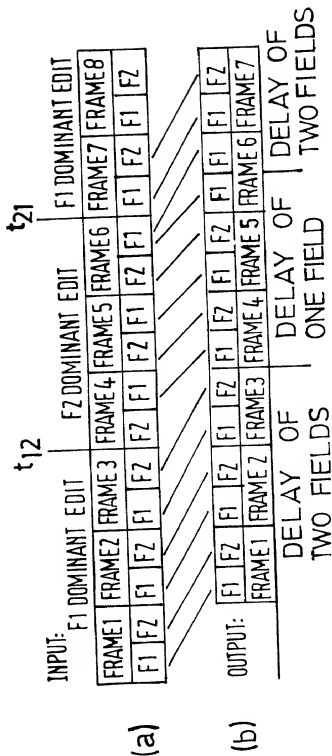
FIG.7
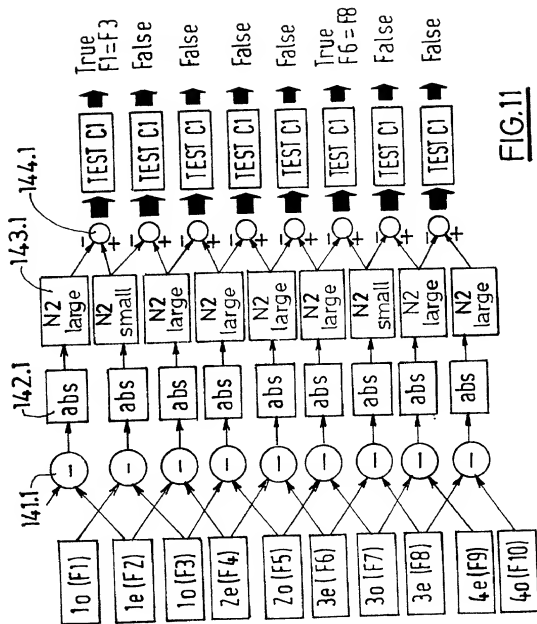
FIG.11

DECLARATION and POWER OF ATTORNEY

As a below named inventor, I hereby declare that:
My residence, post office address and citizenship are as stated below next to my name.
I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled
"Method and device for encoding video signals"
the specification of which (check one)
☐ is attached hereto.
☐ was filed on _____ as Application Serial No. _____ and was amended on
_____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by the amendment(s) referred to above.

I acknowledge the duty to disclose information which is material to patentability of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

PRIOR FOREIGN APPLICATION(S)

COUNTRY	APP. NUMBER	DATE OF FILING (DATE, MONTH, YEAR)	PRIORITY CLAIMED UNDER 35 U.S.C. 119
Europe	99401969.3	3 August 1999	YES
Europe	99403228.2	21 December 1999	YES

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35 United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1,56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:
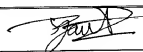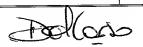
PRIOR UNITED STATES APPLICATION(S)

APPLICATION SERIAL NUMBER	FILING DATE	STATUS (PATENTED, PENDING, ABANDONED)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

Algy Tamoshunas, Reg. No. 27,677
Jack E. Haken, Reg. No. 26,902

SEND CORRESPONDENCE TO: Corporate Patent Counsel;	DIRECT TELEPHONE CALLS TO:
U.S. Philips Corporation; 580 white Plains Road;	(name and telephone No.)
Tarrytown, NY 10591	(914) 332-0222

Dated:	Inventor's Signature:		
Full Name of in Inventor	Last Name **GAUTIER**	First Name **Pierre**	Middle Name
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Post Office Address	Street **7 rue Théodore Honoré**	City **94130 Nogent-Sur-Marne**	State of Country France	Zip Code

Dated:	Inventor's Signature:		
Full Name of in Inventor	Last Name **DEL CORSO**	First Name **Sandra**	Middle Name
Residence & Citizenship	City **Clamart**	State of Foreign Country France *FRX*	Country of Citizenship France
Post Office Address	Street c/o Melle Vigier, **124, Avenue Jean-Jaurès**	City **92140 Clamart**	State of Country France	Zip Code

Combined Declaration For Patent Application and Power of Attorney (Continued) (includes Reference to PCT International Applications)			Attorneys Docket Number **PHF 99.621 US**

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) abnd/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration number)

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	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
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	RESIDENCE & CITIZENSHIP	CITY **Nogent-Sur-Marne**	STATE OR FOREIGN COUNTRY **France**	COUNTRY OF CITIZENSHIP **France**
	POST OFFICE ADDRESS	POST OFFICE ADDRESS **7 rue Théodore Honoré**	CITY **94130 Nogent-Sur-Marne**	STATE & ZIP CODE/COUNTRY **France**
202	FULL NAME OF INVENTOR	FAMILY NAME **DEL CORSO**	FIRST GIVEN NAME **Sandra**	SECOND GIVEN NAME
	RESIDENCE & CITIZENSHIP	CITY **Clamart**	STATE OR FOREIGN COUNTRY **France**	COUNTRY OF CITIZENSHIP **France**
	POST OFFICE ADDRESS	POST OFFICE ADDRESS **c/o Melle Vigier, 124, Avenue Jean-Jaurès**	CITY **92140 Clamart**	STATE & ZIP CODE/COUNTRY **France**
203	FULL NAME OF INVENTOR	FAMILY NAME **LEMAGUET**	FIRST GIVEN NAME **Isabelle**	SECOND GIVEN NAME
	RESIDENCE & CITIZENSHIP	CITY **Paris**	STATE OR FOREIGN COUNTRY **France**	COUNTRY OF CITIZENSHIP **France**
	POST OFFICE ADDRESS	POST OFFICE ADDRESS **App. B471 - 36, rue de Picpus**	CITY **75012 Paris**	STATE & ZIP CODE/COUNTRY **France**
204	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
	RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY
205	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
	RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true: and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 if Title 18 of the United states Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201 CITY	SIGNATURE OF INVENTOR 202	SIGNATURE OF INVENTOR 203
DATE 22 February 2001	DATE 22 February 2001	DATE 22 February 2001
SIGNATURE OF INVENTOR 204	SIGNATURE OF INVENTOR 205	
DATE	DATE	

U.S. DEPARTMENT OF COMMERCE- Patent and Trademarks Office

(July 1994)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: **"Method and device for encoding video signals"**
the specification of which (check only one item below):

☐ is attached hereto.

☐ was filed as United States application

Serial No _____

on _____

and was amended

on _____

☒ was filed as PCT international application

Number   PCT/EP00/07425

on   31 July 2000

and was amended under PCT Article 19

on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY	APPLICATION NUMBER	DATE OF FILING DAY, MONTH, YEAR	PRIORITY CLAIMED UNDER 35 USC 119
Europe	**99401969.3**	**3 August 1999**	**YES**
Europe	**99403228.2**	**21 December 1999**	**YES**

Dated:		Inventor's Signature:			
Full Name of in Inventor	Last Name **LEMAGUET**	First Name **Isabelle**		Middle Name	
Residence & Citizenship	City **Paris**	State of Foreign Country **France**		Country of Citizenship **France**	
Post Office Address	Street **App. B471 - 36, rue de Picpus**	City **75012 Paris**		State of Country **France**	Zip Code
Dated:		Inventor's Signature:			
Full Name of in Inventor	Last Name	First Name		Middle Name	
Residence & Citizenship	City	State of Foreign Country		Country of Citizenship	
Post Office Address	Street	City		State of Country	Zip Code
Dated:		Inventor's Signature:			
Full Name of in Inventor	Last Name	First Name		Middle Name	
Residence & Citizenship	City	State of Foreign Country		Country of Citizenship	
Post Office Address	Street	City		State of Country	Zip Code

JC10 Rec'd PCT/PTO 2 6 MAR 2001

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of   Atty. Docket

PIERRE GAUTIER ET AL   PHF 99,621

Serial No.:

Filed: CONCURRENTLY

Title: METHOD AND DEVICE FOR ENCODING VIDEO SIGNALS

Commissioner for Patents
Washington, D.C. 20231

APPOINTMENT OF ASSOCIATES

Sir:

The undersigned Attorney of Record hereby revokes all
prior appointments (if any) of Associate Attorney(s) or Agent(s) in
the above-captioned case and appoints:

RUSSELL GROSS   (Registration No. <u>40,007</u>)

MICHAEL E. MARION   (Registration No. <u>32,266</u>)

c/o PHILIPS ELECTRONICS NORTH AMERICA CORPORATION, Corporate
Intellectual Property, 580 White Plains Road, Tarrytown, New York
10591, his Associate Attorney(s)/Agent(s) with all the usual powers
to prosecute the above-identified application and any division or
continuation thereof, to make alterations and amendments therein,
and to transact all business in the Patent and Trademark Office
connected therewith.

ALL CORRESPONDENCE CONCERNING THIS APPLICATION AND THE
LETTERS PATENT WHEN GRANTED SHOULD BE ADDRESSED TO THE UNDERSIGNED
ATTORNEY OF RECORD.

Respectfully,

k E. Haken, Reg. 26,902
torney of Record

Dated at Tarrytown, New York
on March 22, 2001.

F:\WPDOCS\GR\me22grb0.ec0.doc

SCANNED, #